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ABSTRACT

A discussion of numeracy (the ability to cope confidently with the mathematical demands of everyday life), focuses on provision of numeracy instruction alongside English-as-a-Second-Language (ESL) instruction for learners with low literacy skills. It looks first at considerations and methods for assessing student numeracy needs, including the nature of adult learning, student preferences and abilities, and differences in the uses of mathematical symbols and forms of computation in the learners' native language and culture. The discussion then turns to the attitudes and approaches to numeracy of ESL and literacy instructors, who may not be familiar with or comfortable with mathematics or mathematics teaching and may see mathematics skills as discrete and separate from literacy rather than as integral to it. Recommendations for training to teach adult mathematical literacy, based on recent initiatives, are offered. Specific classroom techniques for effective lesson planning and presentation are also outlined. Two numeracy activities, one introducing a place-value chart and one on metric measurement, are offered as illustrations of effective techniques. (MSE) (Adjunct ERIC Clearinghouse on Literacy Education)

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National Clearinghouse for ESL
Literacy Education

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By Tom Ciancone

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Numeracy in the Adult ESL Classroom

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Numeracy is the ability to cope confidently with the mathematical demands of everyday life in the home, workplace, and community (Cockcroft, 1982; Withnall, 1995). The tools of mathematics provide adults with the resources to express facts and opinions and to analyze situations. Knowing how to calculate percentages, for example, is necessary for discount shopping and for figuring sales tax. For many adults, expressing and using the abstract concepts of mathematics is not an easy task, in part, because numeracy needs change as one's life circumstances change. However, like literacy, numeracy is not a case of one's either being proficient or not, rather individuals' skills are "situated along a continuum of different purposes and levels of accomplishment with numbers" (Kerka, 1995, p.1).

This digest examines numeracy for adults learning English as a second language (ESL) as well as for those who teach them. It focuses on learners with low literacy skills and provides curriculum ideas and resources for use in the classroom. While many suggestions are based on the author's experiences in teaching adult immigrants in Canada, they are applicable to adult ESL instruction in other English-speaking countries.

Assessing Numeracy Needs

Adult ESL Learners

In developing a methodology for numeracy instruction, an instructor must consider not only the nature of mathematics learning, but also the nature of adult learners. Determining appropriate instructional methods depends both on learners' mathematical skills and on their attitude toward mathematics. For the ESL learner, proficiency in English will be an additional factor. Although mathematical concepts may be generalizable to many languages and cultures, these concepts must be learned and expressed through particular languages. Whereas "2 + 2 = 4" may be widely understood, the English expression "two plus two equals four" is not. Thus a learner's difficulties in numeracy may be due in part to a lack of proficiency in English.

Decisions regarding topics to be covered should be based on a needs assessment that takes into account both what the learners *want* to do and what they *can* do. Needs may be assessed in a number of ways, from asking about learners' experience in school mathematics to having them try math problems related to a skill they want to learn, e.g., calculating whether it is to their economical advantage to buy a monthly bus pass. To ensure that the class is meeting learners' needs, the instructor should continually monitor their progress and encourage self-assessment.

It is also important to be aware of differences in the use of mathematical symbols in learners' native languages and differences in methods of computation that result from their previous schooling. For example, there is variation in the world's languages in the use of the comma and the decimal point for writing numbers greater than a thousand and numbers as decimals. If a postal carrier earns $32,578.50 in Canada or the United States, most persons from non-English-speaking countries would write the salary as $32.578,50—i.e., with the point and comma reversed.

Another common difference is the method of writing out long division computations. For a class party, if 16 people wish to share equally the bill for some pizzas that cost $42.40, there are at least three different ways to do the division:

$$\begin{array}{r} 2.65 \\ 16\overline{)\,42.40} \end{array} \qquad \begin{array}{l} 42.40\overline{)\,16} \\ \quad 2.65 \end{array} \qquad 42.40 \div 16 = 2.65$$

Writing $42.40\overline{)16}$ instead of $16\overline{)42.40}$ is not backwards; rather it is simply another way of symbolizing the operation of long division. Because there are often multiple ways to solve problems, it is best to observe how learners approach them and build on that. However, adult ESL learners may ask to learn the *new* way so that they may help their children in school.

Adult ESL and Literacy Instructors

In addition to addressing learner needs, instructors need to consider their own attitudes about numeracy (Kallenbach, 1994; Leonelli & Schwendeman, 1994; Stoudt, 1994). Many ESL and adult literacy educators may not be comfortable with math and may teach math skills as discrete and isolated rather than "relevant, contextualized, and essentially linked to overall literacy" (Stoudt, 1994, p.11).

Educators in the United States are beginning to form local and national groups to improve their own and others' math teaching practice. In 1992, 22 adult basic education (ABE), ESL, adult secondary education (ASE), general education development (GED), and workplace education practitioners in Massachusetts collaborated to form the ABE Math team. Using the standards from the National Council of Teachers of Mathematics as a model, they developed 12 math standards for teaching adults (Leonelli & Schwendeman, 1994) that stressed the importance of learning through discovery rather than through rote study of textbooks, the value of understanding over memorization, and the usefulness of such generally undervalued skills as estimating totals (Kallenbach, 1994).

In 1994, in Arlington, Virginia, 110 adult educators from 30 states met for a three-day working conference on adult mathematical literacy. Their recommendations included the following:

- Class math activities should be collaborative, involve problem-solving, and help learners develop reasoning skills.
- Diagnostic assessment tools need to be developed to inform all stakeholders—learners, instructors, evaluators, and program funders.
- Support for professional development for teachers is needed (Gal & Schmitt, 1995).

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Guidelines for Teaching Numeracy

To facilitate numeracy learning in an ESL literacy program, Ciancone and Jay (1991), Kallenbach (1994), Leonelli and Schwendeman (1994), and Lucas, Dondertman, and Ciancone (1991) offer the following suggestions:

- Encourage looking for patterns rather than finding the right answer.
- Stress the possibility that there may be many ways to solve the same problem.
- Encourage peer-group collaboration. The best way to clarify one's own understanding of a concept is to explain it to someone else.
- Encourage learners to write journals about the math skills they are learning and their feelings about learning math. Using the language of mathematics reinforces both the mathematical concepts and proficiency in English.
- Although numeracy is an everyday coping skill, mathematical concepts can be quite abstract; the more concrete and visual the explanation, the more easily understood the abstract concept.
- Each numeracy lesson should provide a balance between skill building and functional needs. A lesson may begin with a problem (e.g., a mistake on a paycheck) that provides a context for learning new skills (such as subtracting decimals), or the lesson may start with a skill (e.g., adding decimals) followed by practical applications (such as adding sales tax to a fast food bill).
- Include math in literacy instruction from the beginning. Even learners who have almost no proficiency in English need to learn numbers for such basic activities as shopping and riding the bus.

Some Numeracy Activities

As learners develop language skills, they can also develop skills such as estimating, measuring, and analyzing data. Activities for numeracy learning can range from recognizing numbers to calculating percentages, from reading a bus schedule to baking a cake. The two activities described below have been useful for helping beginning numeracy learners understand number systems.

Place-Value Chart

The place-value chart reinforces the essential mathematical concept of place value while helping ESL learners to read large numbers. It is a series of adjacent columns with headings that designate their value. From right to left the headings are "Ones," "Tens," "Hundreds," "Thousands," and so on as high as "Billions," if needed. The chart can be used in a variety of ways. The instructor can simply dictate numbers and ask the learners to write them in the correct columns on the chart. Or this exercise can be combined with questions, such as, "How many days are there in a year?" or "What is the population of Ontario?" If a class is reading a newspaper article that involves large numbers (e.g., corporate profits), the instructor can have learners underline numbers and then copy them onto the place-value chart. The chart can also be used when writing numbers in words, as required in writing checks.

A related activity is to make a large money chart. The headings on this chart are (from right to left) "Pennies," Dimes, "Ones," Tens," and "Hundreds, with the decimal point between the "Ones" and "Dimes." The columns are large enough to allow placement of real money or facsimiles on the chart. The money chart is an excellent tool for learners who have difficulty with carrying and borrowing in addition and subtraction.

Metric Measurement

A unit on metric measurement can include topics of length, distance, area, volume, and weight to teach functional language skills related to dimensions and mathematical skills involving decimals. The following activity presupposes a preliminary understanding of metric units, a reasonable expectation of learners educated outside the United States. U.S. measurements can also be used, or an activity can be done comparing the two systems of measurement.

The learners work in pairs, each pair with one meter stick or ruler, or both. A dialogue such as the following occurs in which learners take turns estimating the length or size of something in the classroom:

A: How long is the table?

B: It's about 2 meters long.

A: Let's measure it.

The learners measure the table and record the exact measurement. Then the second learner might ask, "How high is the ceiling?" and so on. From here more complex dialogues can be developed.

This activity provides a starting point for learning decimals. For example, learners may measure the width of a piece of paper as 21.6 cm with the ruler and see that 21.6 cm is just over halfway between 21 cm and 22 cm. In fact, 0.6 cm is six-tenths of one whole centimeter. Using the ruler as a concrete aid, the teacher can introduce the concept of decimal before the learners have mastered fractions.

Conclusion

Numeracy includes a range of skills that are necessary for initial survival in a new country and for functioning as a fully literate person. In programs for adults learning English as a second language, both the mathematical skills and the language for these skills need to be integrated into the curriculum in order to prepare the learners to be successful. Instructors interested in integrating numeracy-related activities into their classes should evaluate their own perspectives on numeracy and advocate for training and professional development to improve their math teaching practice.

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